DECLARATION

I, TAKAO MATSUI, a Japanese Patent Attorney registered No. 12006, of Okabe International Patent Office at No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the priority documents of Japanese Patent Application No. 2003-108397 filed on March 7, 2003 in the name of CANON KABUSHIKI KAISHA and CANON FINETECH INC..

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 19th day of October, 2006

TAKAO MATSUI

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[Title of the Invention] SHEET PROCESSING APPARATUS AND IMAGE FORMING APPARATUS EQUIPPED WITH SAME

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[Inventor]
[Domicile or Residence] c/o Canon Kabushiki Kaisha
30-2, 3-chome, Shimomaruko,
Ohta-ku, Tokyo

[Name] TOMOKAZU NAKAMURA

[Inventor]
[Domicile or Residence] c/o Canon Kabushiki Kaisha
30-2, 3-chome, Shimomaruko,
Ohta-ku, Tokyo

[Name] MASATOSHI YAGINUMA

[Inventor]
[Domicile or Residence] c/o Canon Finetech INC.
5540-11, Sakate-machi, Mitsukaido-shi,
Ibaraki-ken

[Name] ATSUSHI TAKADA

[Inventor]
[Domicile or Residence] c/o Canon Finetech INC.
5540-11, Sakate-machi, Mitsukaido-shi,
Ibaraki-ken

[Name] MASAHIRO YONENUMA

[Inventor]
[Domicile or Residence] c/o Canon Kabushiki Kaisha
30-2, 3-chome, Shimomaruko,
Ohta-ku, Tokyo

[Name] YOSHINORI ISOBE

[Inventor]
[Domicile or Residence] c/o Canon Kabushiki Kaisha
30-2, 3-chome, Shimomaruko,

Ohta-ku, Tokyo

[Name] TOSHIMASA SUZUKI

[Inventor]
[Domicile or Residence] c/o Canon Finetech INC.
5540-11, Sakate-machi, Mitsukaido-shi,
Ibaraki-ken

[Name] NORIO MOTOI

[Applicant]

[Identification No.] 000208743

[Name] CANON FINETECH INC.

[Applicant]

[Identification No.] 000001007

[Name] CANON KABUSHIKI KAISHA

[Attorney]

[Identification No.] 100082337

[Patent Attorney]

[Name] KAZUO CHIKASHIMA

[Elected Attorney]

[Identification No.] 100083138

[Patent Attorney]

[Name] SHINJI AIDA

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Identification No. [000001007]

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Address: 3-30-2, Shimomaruko, Ohta-ku, Tokyo

Name: CANON KABUSHIKI KAISHA

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This is to certify that the annexed is a true copy of the following application as filed with this office.

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[Name of the Document] Specification

[Title of the Invention] Sheet Processing Apparatus And Image Forming Apparatus Including The Sheet Processing Apparatus

[What is Claimed is]

[Claim 1]

A sheet processing apparatus, comprising:

first sheet stacking means on which sheets are stacked and the sheets are processed;

second sheet stacking means provided downstream of said first sheet stacking means in a direction to which a sheet is conveyed;

first sheet conveying means for conveying the sheets stacked on said first sheet stacking means and discharging the sheets onto said second sheet stacking means; and

second sheet conveying means for conveying the sheets stacked on said first sheet stacking means towards said second sheet stacking means,

wherein sheets stacked on said first sheet stacking mean is discharged onto said second sheet stacking means by said first sheet conveying means and said second sheet conveying means.

[Claim 2]

A sheet processing apparatus comprising:

sheet holding means which holds multiple sheets in piles;

first sheet stacking means which stacks the sheets held by the sheet holding means or the sheets passing through said sheet holding means without stopping and processes the sheets;

second sheet stacking means provided downstream of said first sheet stacking means in a direction to which a sheet is conveyed;

first sheet conveying means for conveying the sheets stacked on said first sheet stacking means and discharging the sheets onto said second sheet stacking means; and

second sheet conveying means for conveying the sheets stacked on said first sheet stacking means towards said second sheet stacking means,

wherein after said second sheet conveying means conveys a predetermined amount among the sheets stacked on said first sheet stacking means to a side of second sheet stacking means, said first sheet conveying means conveys the sheets held by said sheet holding means and the sheets stacked on said first sheet conveying means together and discharges the sheet stacked on said first sheet conveying means onto said second sheet stacking means.

[Claim 3]

A image processing apparatus comprising:

image forming means for forming an image on a sheet;

sheet processing device which processes the sheet on which an image is formed by said image forming means; and

a sheet processing apparatus according to any one of Claims 1 or 2.

[Detailed Description of the Invention]

[0001]

[Field of the Industrial Utilization]

The present invention relates to a sheet processing apparatus or an image forming apparatus having the sheet processing apparatus. The sheet processing apparatus is detachably provided to an apparatus main body of an image forming apparatus such as a copying machine or a printer, or integrally provided to the apparatus main body of an image forming apparatus.

[0002]

[Prior Art]

In recent years, a sheet processing apparatus such as a sorter for sorting sheets, on which an image has been formed, as an option for an image forming apparatus such as an electrophotographic copying machine or a laser beam printer. This kind of sheet processing apparatus is adapted to apply one of sort processing, stitch processing, alignment processing, and the like to sheets.

[0003]

A sheet processing apparatus including a stapler for stitching sheets with needles is adapted to, after causing

sheets, which are conveyed into a sheet processing apparatus main body, to pass through a conveyance path formed in the inside of the main body and stacking the sheets on a processing tray, perform a stitching action.

[0004]

A sheet processing apparatus for stitching a sheet stack is adapted to stack sheets on a processing tray in bundles and move a stapler serving as stitching means to perform one position stitch or multiple-position stitch (usually two-position stitch). While a stitching action is performed, sheets of the next job cannot be stacked on the processing tray. Consequently, sheets are required to be supplied on the basis of job unit in which the stitching action is performed.

[0005]

However, when the sheets are supplied at intervals, productivity declines. In other words, the number of sheets to be processed per unit time decreases. As a sheet processing apparatus for preventing the decline in productivity, there is a sheet processing apparatus shown in Fig.31(e.g., Patent Related Document 1).

[0006]

A conventional type of a sheet processing apparatus 10 shown in Fig.31 has a buffer roller path 14 which is capable of waiting for conveying a sheet to post processing tray 11 in a condition where a sheet is twisted around a rotating buffer roller 13 at a conveying path 12 on a way to the post

processing tray when a sheet is conveyed.

[0007]

With such a structure, the conventional sheet processing apparatus 10 stores sheets, which are conveyed from a discharge roller pair 17 in an apparatus main body 16 of an image forming apparatus 15, in the buffer roller path 14. After a preceding sheet stack has undergone, for example, a stitch action on the post-processing tray 11, and an upper roller 18a and a lower roller 18b of an oscillation roller pair 18 have nipped to discharge sheets, while rotating, from the post-processing tray 11, the sheet processing apparatus 10 conveys the sheet stack stored in the buffer roller 13 to the post-processing tray 11 to thereby prevent the decline in productivity without increasing conveyance intervals among the sheets during the stitch action.

[0008]

[Patent Document 1]

Japanese Patent Application Laid-Open No. H9-48545 (Figs. 1 and 2)

[0009]

[Problems to be Solved by the Invention]

However, since the conventional sheet processing apparatus 10 includes the buffer roller path 14 and requires a space for setting the buffer roller 13 and the buffer roller path 14, which stop conveyance of subsequent sheets to the post-processing tray 11 to cause sheets to stand by during a stitch action, a size of the sheet processing apparatus itself

increases to cause an increase in costs.

[0010]

In addition, since the conventional sheet processing apparatus 10 discharges sheets with the oscillation roller pair 18, a discharge action of sheets is irregular to cause unevenness of time required for sheet discharge.

[0011]

Moreover, although the conventional sheet processing apparatus 10 is adapted to stack sheets, which are stored in the buffer roller path, on the post-processing tray 11 after discharging sheets on the post-processing tray 11, the sheet processing apparatus 10 is not suitable for the recent actual situation in which high-speed processing is required. Thus, an apparatus with shorter processing time has been expected.

[0012]

A purpose of the invention is to provide a sheet processing apparatus which is ensured to discharge a sheet.

[0013]

Another purpose of the invention is to provide an image forming apparatus including a sheet processing apparatus which is ensured to discharge a sheet, wherein the image forming apparatus includes which increases a production efficiency.

[0014]

[Means for Solving the Problems]

In order to achieve the purpose of the above mentioned purpose, it is provided, a sheet processing apparatus,

comprising first sheet stacking means on which sheets are stacked and the sheets are processed, second sheet stacking means provided downstream of said first sheet stacking means in a direction to which a sheet is conveyed, first sheet conveying means for conveying the sheets stacked on said first sheet stacking means and discharging the sheets onto said second sheet stacking means; and second sheet conveying means for conveying the sheets stacked on said first sheet stacking means towards said second sheet stacking means, wherein sheets stacked on said first sheet stacking mean is discharged onto said second sheet stacking means by said first sheet conveying means and said second sheet conveying means.

[0015]

In order to achieve the purpose of the above mentioned purpose, it is provided, a sheet processing apparatus comprising sheet holding means which holds multiple sheets in piles, first sheet stacking means which stacks the sheets held by the sheet holding means or the sheets passing through said sheet holding means without stopping and processes the sheets, second sheet stacking means provided downstream of said first sheet stacking means in a direction to which a sheet is conveyed, first sheet conveying means for conveying the sheets stacked on said first sheet stacking means and discharging the sheets onto said second sheet stacking means, and second sheet conveying means for conveying the sheets stacked on said first sheet stacking means towards said second sheet stacking means, wherein after said second sheet conveying means conveys a

predetermined amount among the sheets stacked on said first sheet stacking means to a side of second sheet stacking means, said first sheet conveying means conveys the sheets held by said sheet holding means and the sheets stacked on said first sheet conveying means together and discharges the sheet stacked on said first sheet conveying means onto said second sheet stacking means.

[0016]

In order to achieve the purpose of the above mentioned purpose, it is provided, an image processing apparatus comprising image forming means for forming an image on a sheet, a sheet processing device which processes the sheet on which an image is formed by said image forming means; and a sheet processing apparatus according to either one of the above-described sheet processing apparatus.

[0017]

[Detailed Description of the Preferred Embodiments]

A sheet processing apparatus of an embodiment of the present invention and a copying machine, which is an example of an image forming apparatus including this sheet processing apparatus, will be hereinafter described with reference to the accompanying drawings. Note that examples of the image forming apparatus include a copying machine, a facsimile apparatus, a printer, and a multifunction machine of these apparatuses, and the image forming apparatus including the sheet processing apparatus is not limited to a copying machine.

[0018]

Further, dimensions, numerical values, materials, shapes, a relative arrangement of the components described in this embodiment, and the like are not meant to limit a scope of the present invention only to them unless specifically described otherwise.

[0019]

In the description of the embodiments, a case in which the sheet processing apparatus is an optional apparatus, which is constituted to be detachably mountable to an apparatus main body of the image forming apparatus as an independent apparatus, will be described as an example. Note that it is needless to mention that the sheet processing apparatus of the present invention is also applied to a case in which the sheet processing apparatus is integrally provided in the image forming apparatus. However, since this case is not particularly different in function from the case of a sheet processing apparatus, which is described later, a description of the case will be omitted.

[0020]

Fig. 1 is a schematic sectional view showing a state in which a sheet processing apparatus is mounted to a copying machine. Note that the sheet processing apparatus is specifically, for example, a finisher.

[0021]

(Image forming apparatus)

A copying machine 100 is constituted by an apparatus main body 101 and a sheet processing apparatus 119. An

original feeding apparatus 102 is mounted above the apparatus main body 101. Originals D are mounted on an original mounting portion 103 and are sequentially separated one by one by a feeding portion 104 to be supplied to a registration roller pair 105. Subsequently, the original D is stopped by the registration roller pair 105 once and looped to correct skew feeding. Thereafter, the original D passes on an introduction path 106 to pass through a reading position 107, whereby an image formed on the surface of the original is read. The original D having passed through the reading position 108 passes on a discharge path 107 to be discharged on a discharge tray 109.

[0022]

In addition, in the case in which both sides of an original is read, first, the original D passes through the reading position 108, whereby an image on one side of the original is read. Thereafter, the original D passes on the discharge path 107 and is conveyed by a reverse roller pair 110 in a switch-back manner and sent to the registration roller pair 105 again in a state in which the sides are reversed.

[0023]

Then, skew feeding of the original D is corrected in the registration roller pair 105 in the same manner as reading the image on the one side. The original D passes on the introduction path 106, and an image on the other side is read in the reading position 108. Then, the original D passes on the discharge path 107 to be discharged to the discharge tray

109.

[0024]

On the other hand, light of a lighting system 111 is applied on an image of an original passing through the reading position 108. Reflected light from the original is guided to an optical element 113 (CCD or other elements) by mirrors 112, and image data is obtained. Then, a laser beam based upon this image data is applied on, for example, a photosensitive drum 114 serving as image forming means to form a latent image. Note that, although not shown in the figure, it is also possible to constitute the image forming apparatus such that the reflected light is directly applied on the photosensitive drum 114 by the mirrors 112 to form a latent image.

[0025]

A toner image is formed from the latent image formed on the photosensitive drum 114 by a toner supplied from a toner supply apparatus (not shown). Recording media, which are sheets of paper or plastic film, are stacked on a cassette 115. A sheet is fed from the cassette 115 in response to a recording signal and enters between the photosensitive drum 114 and a transfer apparatus 116 with timing for entering adjusted by a registration roller pair 150. Then, a toner image on the photosensitive drum 114 is transferred onto the sheet by transfer apparatus 116. The sheet having the toner image transferred thereon is heated and pressurized by a fixing apparatus 117 while the sheet passes through the fixing apparatus 117, whereby the toner image is fixed.

[0026]

In the case in which images are formed on both sides of a recording medium, a sheet, on one side of which an image is fixed by the fixing apparatus 117, passes on a two-side path 118 provided on a downstream side of the fixing apparatus 117, fed into between the photosensitive drum 114 and the transfer apparatus 116 again, and a toner image is transferred onto a back side as well. Then, the toner image is fixed by the fixing apparatus 117, and the sheet is discharged to the outside (a finisher 119 side).

[0027]

Fig. 2 is a control block diagram of the entire copying machine. The entire copying machine 100 is adapted to be controlled by a CPU 201. A ROM 202, which has stored therein sequences for each portion, that is, control procedures of respective portions, and a RAM 203, in which various kinds of information are temporarily stored as required, are provided in the CPU circuit portion 200. An original feeding apparatus control portion 204 is adapted to control an original feeding action of an original deeding apparatus 102. An image reader control portion 205 is adapted to control a lighting system 111 or the like to control reading of an original. An image signal control portion 206 is adapted to receive reading information of the image reader control portion 205 or image information, which is sent from an external computer 207, via an external I/F 208, process the information, and send a processing signal to a printer control portion 209. The printer control portion

209 is adapted to control the photosensitive drums 114 and the like on the basis of the image processing signal from the image signal control portion 206 to make it possible to form an image on a sheet.

[0028]

An operation portion 210 is adapted to be able to input information on what kind of processing is applied to a sheet, for example, information for performing staple processing. In addition, the operation portion 210 is adapted to be able to display information on an action state or the like of the apparatus main body 101 of the copying machine and the finisher 119 serving as a sheet post-processing apparatus. A finisher control portion 21 is adapted to control actions in the finisher 119 serving as a sheet post-processing apparatus. A FAX control portion 212 is adapted to control the copying machine such that the copying machine can be used as a facsimile apparatus to transmit/receive signals with other facsimile apparatuses.

[0029]

(Sheet processing apparatus)

Fig. 3 is a longitudinal sectional view of a sheet processing apparatus. Fig. 4 is a longitudinal sectional view showing respective drive systems. Fig. 8 is a control block diagram of the sheet processing apparatus. Fig. 9 is a flowchart for explaining actions of the sheet processing apparatus. Figs. 10 to 12 are diagrams showing a relation between a moving speed of a trailing edge assist 134 and a

sheet conveyance speed of an oscillation roller pair 127 with respect to an elapsed time. Fig. 10 is a solo stack delivery sequence for feeding a sheet stack with the trailing edge assist 134 and the oscillation roller pair 127. Fig. 11 is a diagram of stack delivery control in the case in which start speeds of the trailing edge assist 134 and the oscillation roller pair 127 are different. Fig. 12 is a diagram of a simultaneous stack delivery sequence for simultaneously conveying a sheet stack and a buffer sheet stored in a buffer unit 140 with the trailing edge assist, the oscillation roller pair, and the first conveyance roller pair.

[0030]

The sheet processing apparatus 119 is provided with a function for bookbinding a sheet stack and includes a stapler unit 132 which stitches parts near the edge of the sheet stack, a stapler 138 which stitches the center of the sheet stack, a folding unit 139 which folds the parts of stitch positions of the sheet stack stitched by the stapler 138 to form the sheet stack in a book shape, and the like.

[0031]

The sheet processing apparatus 119 of this embodiment includes the buffer unit 140 which stacks and stores (buffers) plural sheets in a straight state during operation of the stapler unit 132.

[0032]

Since this buffer unit 140 is adapted to stack and store plural sheets in a straight state, unlike the

conventional mechanism having the buffer roller, the sheets can be made flat, and a size and a weight of the sheet processing apparatus can be reduced. Moreover, since the sheets can be stored in a straight state, unlike the case of the buffer roller, the sheets are not rolled up. Thus, since the sheets can be easily handled, a processing time for the sheets of the sheet processing apparatus can be reduced.

[0033]

The sheet processing apparatus 119 is adapted to be controlled by a finisher control portion 211 shown in Figs. 6 and 7. A ROM 222, which has stored therein a control procedure (sequence) of the sheet processing apparatus 119 operating on the basis of an instruction from the CPU circuit 200 of the apparatus main body of the copying machine, a RAM 203, which temporarily stores information required for controlling the sheet processing apparatus 119 each time it is controlled, and the like are provided in a CPU 221 of the finisher control portion 211. In addition, a sheet surface detection sensor 224, which operates on the basis of an action of a sheet surface detection lever 133 to be described later, is connected to the finisher control portion 211. The CPU 221 is adapted to control ascent and decent of a stack tray 128 on the basis of a sheet detection signal of the sheet surface detection sensor 224. The finisher control portion 211 is adapted to control to operate an inlet conveyance motor M2 which rotates an inlet roller pair 121, a buffer roller 124, and a first discharge roller pair, a stack delivery motor M3 which rotates an

oscillation roller pair 127 and a return roller 130, an under-stack clutch CL which transmits the rotation of the stack delivery motor M3 to a lower roller 127b or disconnects the rotation, and the like on the basis of the above-mentioned sequence.

[0034]

Note that the CPU circuit portion 200 in Fig. 2 and the finisher control portion 211 may be integrally formed.

[0035]

The under-stack clutch CL shown in Fig. 4 is provided in order to absorb a speed difference. This is because, since the lower roller 127b and the return roller 130 to be described later are rotated by the common stack delivery motor M3, if slip occurs or a sheet conveyance speed difference is generated in both the rollers when a sheet or a sheet stack is conveyed by the lower roller 127b and the return roller 130, it is likely that wrinkles are formed on the sheet or the sheet stack or that the sheet or the sheet stack is scratched.

[0036]

(Explanation of an action for stitching and discharging a sheet stack)

When sheet stitch processing display of the operation portion 210 (see Fig. 2) of the copying machine 100 is selected by a user, the CPU circuit portion 200 controls the respective portions of the apparatus main body to shift the copying machine to a copying action and, at the same time, sends a sheet stitch processing signal to the finisher control portion

211.

[0037]

Note that the explanation of actions on the basis of Figs. 13 to 19 is an explanation of a case in which the CPU circuit portion 200 judges that a sheet is long on the basis of sheet size information inputted by the user in the operation portion 210 (e.g., the case of an A3 size sheet), or a case in which a sheet is a special sheet, which is provided with attributes different from an ordinary sheet, such as a thick sheet, a thin sheet, a tab sheet, or a color sheet, depending upon sheet type information. In other words, the explanation of actions on the basis of Figs. 13 to 19 is an explanation of a case in which an action for stacking a buffer sheet to be described later on a processing tray 129 is started after a sheet stack is discharged to the stack tray 128. Note that it is needless to mention that actions to be described below may be performed regardless of a length of a sheet and whether or not a sheet is a special sheet.

[0038]

The finisher control portion 211 activates the inlet conveyance motor M2 and the stack delivery motor M3 on the basis of a sheet stitch processing signal. In addition, the finisher control portion 211 operates a buffer roller estrangement plunger SL1 (see Fig. 4) to estrange the buffer roller 124 from the lower conveyance guide plate 123b, and further operates a not-shown plunger to estrange an upper roller 127a of the oscillation roller pair 127 from the lower

roller 127b. Note that the activation and stop of the inlet conveyance motor M2 and the stack delivery motor M3 may be controlled in accordance with movement of a sheet one by one.

[0039]

A first sheet, which has been sent from the discharge roller pair 120 of the apparatus main body 101 of the copying machine 100 (see Fig. 1), is conveyed to the inlet roller pair 121 according to conveyance of a receiving roller pair 137 and guidance of a flapper 122 shown in Figs. 3 and 4. The receiving roller pair 137 is adapted to be rotated by the common conveyance motor M1 which rotates the discharge roller pair 120.

[0040]

As shown in (a) of Fig. 13, the inlet roller pair 121 is rotated by the inlet conveyance motor M2 (see Fig. 4) to convey a first sheet P1. The sheet P1 is conveyed to a first discharge roller pair 126 according to guidance of the guide 123 which is composed of an upper conveyance guide plate 123a and a lower conveyance guide plate 123b.

[0041]

As shown in (b) of Fig. 13, the sheet P1 is further conveyed by the rotation of the first discharge roller pair 126 to be discharged to the stack tray 128 as shown in (a) of Fig. 14. As shown in (b) of Fig. 14, the sheet P1 falls over the stack tray 128 and the processing tray 129. Thereafter, as shown in (a) and (b) of Fig. 15, the upper roller 127a is lowered by the not-shown plunger to nip the sheet with the

lower roller 127b.

[0042]

At this point, the lower roller 127b has already been rotated in a direction of arrow by the upper roller 127a and the stack delivery motor M3 (see Fig. 4). Moreover, The return roller 130, which comes into contact with and moves away from the processing tray 129 freely, is also rotated in a direction of arrow by the stack delivery motor M3 (see Fig. 4). However, the lower roller 127b is adapted to be coupled with a driving force by an operation of the under-stack clutch CL (see Fig. 4) when a first sheet is conveyed, but is turned off and rotates idly when second and subsequent sheets are conveyed. This is because, when the second and subsequent sheets are stacked after the first sheet is stacked on the processing tray 129, if the lower roller 127b rotates, it is likely that the lower roller 127b pushes the first sheet into a side of a stopper 131 to cause wrinkles on the first sheet.

[0043]

As shown in (a) of Fig. 16, the sheet P1 slides down in a direction of arrow on the processing tray 129 slanting to the lower right according to the rotation of the oscillation roller pair 127 and the return roller 130. At this point, the trailing edge assist 134 stands by in a standby position. Then, before the sheet P1 comes into abutment against the stopper 131, the upper roller 127a moves away from the sheet P1. The sheet P1 is brought into abutment against the stopper 131 by the return roller 130. Thereafter, width alignment of the sheet P1

is performed by a pair of alignment plates 144a and 114b (see Fig. 5).

[0044]

Thereafter, the subsequent sheets are stacked on the processing tray 129 in the same manner. As shown in Fig. 17, when a predetermined number of sheets are stacked on the processing tray 129, the sheets in bundles are stitched by the stapler unit 132 shown in Figs. 3 and 4. Note that, instead of applying the stitch processing to the sheet stack with the stapler unit 132, punch processing may be applied with a not-shown punch unit.

[0045]

As shown in (a) of Fig. 18, the upper roller 127a is lifted by the not-shown plunger and nips a sheet with the lower roller 127b (S101). After about 150 msec has elapsed (S103), the alignment plates 144 retract from a sheet stack (S104), and the stack tray 128 moves to a position where detection by the sheet surface detection lever 13 is effected, moves to a position to which the sheet stack is discharged, and stands by in a position where the stack tray 128 can easily receive the sheet stack to be discharged (S105).

[0046]

As shown in (b) of Fig. 18, the upper roller 127a nips the sheet stack P with the lower roller 127b and rotates in a direction of arrow, and the trailing edge assist 134 pushes the trailing edge of the sheet stack P to discharge the sheet stack to the stack tray 128. As shown in Figs. 5 to 7, the trailing

edge assist 134 is provided in a belt 142 which is rotated regularly and reversely by a trailing edge assist motor M4.

[0047]

At this point, as shown in Figs. 10 and 11, if the oscillation roller pair 127 and the trailing edge assist 134 have the same start time (T1) and the same start speed (132 mm/sec) and reach the same acceleration end speed (500 mm/sec) at the same time (T2), the oscillation roller pair 127 and the trailing edge assist 134 can discharge the sheet stack without applying a tensile force or a compression force to the sheet stack (S106).

[0048]

However, as shown in Fig. 11, the start speed of the trailing edge assist 134 may be lower than the start speed of the oscillation roller pair 127 due to belts 143, 142, and the like which transmit a rotation force of the trailing edge assist motor M4 to the trailing edge assist 134 (the start speed of the trailing edge assist 134 is assumed to be 300 mm/sec). In such a case, the trailing edge assist 134 is at rest without starting movement until a time T3 when the sheet conveyance speed of the oscillation roller pair 127 reaches 300 mm/sec, and starts movement when the sheet conveyance speed of the oscillation roller pair 127 has reached 300 mm/sec. In other words, the trailing edge assist 134 starts when time (T3-T1)=ΔT has elapsed after the oscillation roller pair 127 starts (S107). Note that, in the case in which the start speed of the oscillation roller pair 127 is higher than the start speed of

the trailing edge assist 134, conversely, the start time of the oscillation roller pair 127 is delayed by ΔT. If the start speed of the trailing edge assist 134 and the start speed of the oscillation roller pair 127 are the same, ΔT is zero.

[0049]

In this way, if the time difference of ΔT is provided for the start time, even if there is a difference in the start speeds of the oscillation roller pair 127 and the trailing edge assist 134, the oscillation roller pair 127 and the trailing edge assist 134 can discharge the sheet stack without applying a tensile force and a compression force to the sheet stack. In addition, there is no fear that scratch streak of a roller due to the oscillation roller pair 127 is left on the sheet to deteriorate quality of the sheet stack or quality of an image on the sheet stack.

[0050]

The sheet stack is started to be fed to the stack tray 128 by the oscillation roller pair 127, the trailing edge assist 134, and the return roller 130 (S108). The trailing edge assist 134 returns to an original position (home position) (S110, an action equivalent to "HP delivery control" in Fig. 12) at the point when the trailing edge assist 134 has moved about 15 mm (S109). As shown in Fig. 19, the sheet stack is discharged onto the stack tray 128 by the oscillation roller pair 127. Thereafter, at the point when the upper roller 127a of the oscillation roller pair 127 has estranged from the lower roller 127b, a series of sheet stack delivery actions end (S111,

S112).

[0051]

In (b) of Fig. 18, when the sheet stack is started to be discharged, a first sheet of the next sheet stack has been fed into the inlet roller pair 121.

[0052]

In the sheet processing apparatus 119 of this embodiment, since the trailing edge assist 134 pushes the trailing edge of the sheet stack to convey the sheet stack, unlike a case in which a roller is brought into pressed contact with the surface of the sheet stack and rotated to discharge the sheet stack, it is possible to convey the sheet stack surely without scratching the surface of the sheet stack.

[0053]

(Explanation of a buffer action)

The above explanation of actions is an explanation of actions in the case in which a large interval is provided between sheets to be conveyed and stitch processing can be applied to a sheet stack while the next sheet is being fed into the sheet processing apparatus. The following explanation of actions is an explanation about a buffer action for, in the case in which an interval of conveyance of sheets is short and subsequent sheets are fed into the sheet processing apparatus while processing is being applied to a sheet stack, storing (buffering) the subsequent sheets only during stitch processing.

[0054]

The sheet processing apparatus 119 performs a buffer

action on the basis of a buffer action command of the finisher control portion 211 at the point when the CPU circuit portion 200 judges that an interval of sheets to be sent from the apparatus main body 101 of the copying machine 100 is shorter than a sheet stitch processing time. In this case, the buffer roller 124 is lowered by the plunger SL1 (see Fig. 4) and is in contact with the lower conveyance guide plate 123b.

[0055]

In Fig. 20, it is assumed that a sheet stack is stacked on the processing tray 129 on the basis of the above-mentioned action. It is also assumed that the stitch processing is applied to the sheet stack by the stapler unit 132 (see Figs. 3 and 4).

[0056]

As shown in (a) of Fig. 20, when a first sheet P1 of the next sheet stack is fed into the sheet processing apparatus 119 while staple processing is being applied to a sheet stack P stacked on the processing tray 129, the sheet P1 is fed into the buffer roller 124 by the inlet roller pair 121. The buffer roller 124 is rotated by the inlet conveyance motor M2 (see Fig. 4) to convey the sheet P1 downstream. At this point, an upper first discharge roller pair 126a of the first discharge roller pair 126 is estranged from a lower first discharge roller pair 126b by a first discharge roller estrangement plunger SL2 (see Fig. 4). Note that, the first discharge roller estrangement plunger SL2 is not shown in Fig. 4 because it overlaps the buffer roller estrangement plunger SL1. In addition, the upper

roller 127a of the oscillation roller pair 127 is also estranged from the lower roller 127b by the not-shown plunger.

[0057]

As shown in (b) of Fig. 20, when the trailing edge of the sheet P1 has reached the switch-back point SP, the sheet P1 is returned to the upstream side by reverse rotation of the buffer roller 124 as shown in (a) of Fig. 21. Substantially simultaneously with this, a trailing edge holding-down member 135 is estranged from the lower conveyance guide plate 123b, and a trailing edge receiving portion 136 is opened. It can be detected that the trailing edge of the sheet P1 has reached the switch-back point SP when a predetermined time has elapsed after an inlet path sensor S1, which is disposed in the vicinity of the downstream side of the inlet roller pair 121 shown in Fig. 4, is operated by the leading edge (downstream side edge) of the sheet or according to the rpm of rotations or the like of the buffer roller 124.

[0058]

The upstream edge side of the sheet P1 after the downstream edge of the sheet is detected is received by the trailing edge receiving portion 136 as shown in (a) of Fig. 21. Thereafter, as shown in (b) of Fig. 21, the trailing edge holding-down member 135 returns to the original position and presses the sheet P1 against the lower conveyance guide plate 123b with a friction member 141 provided in the trailing edge holding-down member 135.

[0059]

Thereafter, as shown in (a) of Fig. 22, a second sheet P2 is fed into the sheet processing apparatus 119. The second sheet P2 is conveyed by the inlet roller pair 121. At this point, the sheet P2 passes on the trailing edge holding-down member 135. Thereafter, as shown in (b) of Fig. 22, the sheet P2 is also conveyed by the buffer roller 124.

[0060]

At this point, the first sheet P1 is pressed against the lower conveyance guide plate 123b together with the second sheet P2 by the buffer roller 124 and is about to move to the downstream side following the second sheet P2 being conveyed. However, since the first sheet P1 is pressed against the lower conveyance guide plate 123b by the friction member 141 provided in the trailing edge holding-down member 135, the first sheet P1 never moves.

[0061]

The second sheet P2 is also returned to the upstream side as shown in Figs. 23, and 24 when the trailing edge thereof has reached the switch-back point SP in the same manner as the first sheet P1. Then, the second sheet P2 is laid on the first sheet P1 and pressed against the lower conveyance guide plate 123b by the friction member 141 of the trailing edge holding-down member 135.

[0062]

Thereafter, when a third sheet P3 is fed into the sheet processing apparatus 119 and the trailing edge thereof passes through the inlet roller pair 121 as shown in (a) of Fig.

25, the upper first discharge roller pair 126a nips the first to the third sheets with the lower first discharge roller pair 126c as shown in (b) of Fig. 25. At this point, the third sheet P3 slightly projects further to the downstream side than the first and the second sheets P1 and P2. In addition, around this point, since the stitch processing with respect to the sheet stack on the processing tray 129 has ended, as shown in (a) of Fig. 26, the trailing edge assist 134 moves along the processing tray 129 to lift the trailing edge of the sheet stack. As a result, a downstream edge Pa of the sheet stack P projects further to the downstream side by a length L than a downstream edge P3a of the third sheet P3.

[0063]

Then, as shown in (b) of Fig. 26, the upper roller 127a also moves down and nips the three sheets P1, P2 and P3, and the sheet stack P with the lower roller 127b. Following this, the trailing edge holding-down member 135 is estranged from the second sheet P2 to release the first sheet P1 and the second sheet P2.

[0064]

Thereafter, the three sheets P1, P2 and P3, and the sheet stack P are nipped and conveyed by the oscillation roller pair 127. Then, as shown in (a) and (b) of Fig. 27, when the sheet stack P is discharged to the stack tray 128, the trailing edges of the first sheet P1 and the second sheet P2 slip out of the first discharge roller pair 126, and the upstream side portions of the three sheets are received by the processing

tray 129.

[0065]

In (b) of Fig. 27, as shown in Figs. 11 and 12, if the first discharge roller pair 126, the oscillation roller pair 127, and the trailing edge assist 134 have the same start time (T1) and the same start speed (132 mm/sec) and reach the same acceleration end speed (500 mm/sec) at the same time (T2), the first discharge roller pair 126, the oscillation roller pair 127, and the trailing edge assist 134 can discharge the sheet stack without applying a tensile force or a compression force to the sheet stack and the three sheets. However, in the case in which there is a difference in start speeds, as in S107 in Fig. 9, the first discharge roller pair 126, the oscillation roller pair 127, and the trailing edge assist 134 can discharge the sheet stack without applying a tensile force or a compression force to the sheet stack and the three sheets if a time difference of ΔT is provided to start them. In addition, there is no fear that scratch streak of a roller due to the first discharge roller pair 126 and the oscillation roller pair 127 is left on the sheet to deteriorate quality of the sheet stack or quality of an image on the sheet stack.

[0066]

As shown in (a) and (b) of Fig. 28, the three sheets are slid down and conveyed on the processing tray 129 by the oscillation roller pair 127 and the return roller 130 and received by the stopper 131. During this action, the stack tray 128 moves down once and moves up again after lowering the

upper surface of the sheet stack to a position lower than the sheet surface detection lever 133. At the point when the sheet surface detection lever 133 is operated by the upper surface of the sheet stack, the stack tray 128 stops moving up. As a result, the upper surface of the sheet stack on the stack tray 128 can be held at a predetermined height. Thereafter, the sheets are sequentially stacked on the processing tray 129 without being stored on the lower conveyance guide plate 123b. When the number of the sheets has reached a predetermined number, the sheets are stitched. During this stitch action, first three sheets of the next sheet stack are stored on the lower conveyance guide plate 123b.

[0067]

Note that, although three sheets are stored on the lower conveyance guide plate 123b in the above description, the number of sheets (buffer sheets) to be stored is not limited to three because the number of sheets that can be stored varies according to a length of sheets, a stitching time, a conveyance speed of sheets, and the like.

[0068]

As described above, in the sheet processing apparatus 119 of this embodiment, the downstream edge Pa of the sheet stack P is projected to the downstream side P3a of the third sheet P3 by a length L in (a) of Fig. 26. The reason for this is as described below. Note that the downstream edges P1a and P2b of the first and the second sheets P1 and P2 are located further on the upstream side than the downstream edge P3a of

the third sheet P3.

[0069]

As shown in Fig. 29, if a projecting length of the downstream edge is L1 which is shorter than the length L, a projecting length of the downstream edge is also L1. Consequently, after the oscillation roller pair 127 has discharged the sheet stack P to the stack tray 128, it is possible that a length for gripping three buffer sheets is reduced, and the oscillation roller pair 127 fails to grip the three buffer sheets and cannot feed them to the processing tray 129 surely. Therefore, the sheet stack is projected by the length L with respect to the buffer roller such that the oscillation roller pair 127 can grip buffer sheets surely and feed them into the processing tray 129.

[0070]

In addition, if the projecting length is short, a contact area of a buffer sheet and a sheet stack is increased, and the sheet stack tends to adhere to the buffer sheet and fall on the stack tray 128 slowly. In such a case, when the oscillation roller pair 127 rotates reversely to feed the buffer sheet into the processing tray 129, it is likely that the sheet stack enters the oscillation roller pair 127 while keeping on sticking to the buffer sheet to scratch the sheet stack or cause sheet jam. Therefore, in order to improve a separation property of the sheet stack and the buffer sheet, the sheet stack is projected by the length L with respect to buffer roller.

[0071]

In addition to the above, the sheet processing apparatus 119 of this embodiment is adapted such that the trailing edge assist 134 pushes the trailing edge of a sheet stack. If the trailing edge of the sheet stack is pushed by the trailing edge assist 134 to convey the sheet stack in this way, unlike a case in which a roller is brought into pressed contact with the surface of the sheet stack and rotated to discharge the sheet stack, it is possible to convey the sheet stack surely without scratching the surface of the sheet stack.

[0072]

In other words, as shown in Fig. 30, if a sheet stack is discharged only by the oscillation roller pair 127, it is possible that deviation occurs between an upper sheet and a lower sheet because an amount of conveyance of sheets is different due to the difference in friction between the upper roller 127a and the lower roller 127b against a sheet, the difference in rotation speed, or the like. In such a case, the oscillation roller pair 127 may slide and rotate with respect to the sheet causing scratches on the sheet. In addition, the oscillation roller pair 127 may discharge the sheet stack while twisting the entire sheet stack. As a result, the sheet stack cannot be discharged smoothly, and processing requires long time. Moreover, in the case in which the entire sheet stack is twisted, it is likely that the sheet is torn in stitched parts, and the sheet stack cannot be used.

[0073]

In addition, such a phenomenon tends to occur if a nipping pressure of the oscillation roller pair 127 with respect to the sheet stack is increased in an attempt to discharge and use the sheet stack surely. If the nipping pressure is decreased to the contrary, the sheet stack cannot be conveyed surely. Therefore, it is difficult to set the nipping pressure of the oscillation roller pair 127.

[0074]

Thus, the sheet processing apparatus of this embodiment is adapted to discharge the sheet stack not only by the oscillation roller pair 127 but also by the trailing edge assist 134. Therefore, the oscillation roller pair 127 never slides and rotates with respect to the sheet or twists the sheet stack as described above, and the oscillation roller pair 127 can discharge the sheet stack smoothly and promptly without scratching the sheet and the sheet stack. In addition, the sheet stack can be discharged even if the nipping pressure of the oscillation roller pair 127 is not controlled strictly.

[0075]

As explained above, the sheet processing apparatus has a buffer unit 140 which pools (buffers) plural sheets in a straight when a stapler 132 is active. The present invention can be applied to a sheet processing apparatus having a buffer unit including a buffer roller 13 and a buffer roller path 14 shown in Fig.31 substituting for the buffer roller 140. This is not limited for only a sheet processing apparatus having a buffer unit 140 which pools (buffers) plural sheets in a

straight.

[0076]

In the above explanation, the position of a sheet is detected by a sensor. But, it may use sheet storing information (memory information) managed in the inside part of CPU 221.

[0077]

In addition, the sheet processing apparatus 119 performs the width alignment for aligning a sheet stack on the processing tray 129 from both sides thereof and the trailing edge alignment, and then stitches the sheet stack. However, the sheet stack may be discharged to the stack tray 128 in a state in which the sheet stack has been subjected to the width alignment and the trailing edge alignment without being stitched.

[0078]

Embodiments of the present invention are as described below.

[0079]

(Embodiment 1)

A sheet processing apparatus includes first sheet stacking means on which sheets are stacked and the sheets are processed, second sheet stacking means provided downstream of said first sheet stacking means in a direction to which a sheet is conveyed, first sheet conveying means for conveying the sheets stacked on said first sheet stacking means and discharging the sheets onto said second sheet stacking means; and second sheet conveying means for conveying the sheets

stacked on said first sheet stacking means towards said second sheet stacking means, wherein sheets stacked on said first sheet stacking mean is discharged onto said second sheet stacking means by said first sheet conveying means and said second sheet conveying means.

[0080]

An image processing apparatus of Embodiment 1 ensure to discharge a sheet because a sheet stacked on as sheet stacking mean, e.g. the processing tray 129, is discharged on as second sheet stacking means, e.g. the stack tray 128 by first sheet conveying means, e.g. the oscillation roller pair 127, and second sheet conveying means, e.g. the trailing edge assist 134. In addition, because a sheet is conveyed by the first sheet conveying means and the second sheet conveying means, it can achieve to discharge a sheet quickly without causing variations of the sheet discharge times and provide an apparatus whose processing time is short.

[0081]

(Embodiment 2)

A sheet processing apparatus includes sheet holding means which holds multiple sheets in piles, first sheet stacking means which stacks the sheets held by the sheet holding means or the sheets passing through said sheet holding means without stopping and processes the sheets, second sheet stacking means provided downstream of said first sheet stacking means in a direction to which a sheet is conveyed, first sheet conveying means for conveying the sheets stacked on said first

sheet stacking means and discharging the sheets onto said second sheet stacking means; and second sheet conveying means for conveying the sheets stacked on said first sheet stacking means towards said second sheet stacking means, wherein after said second sheet conveying means conveys a predetermined amount among the sheets stacked on said first sheet stacking means to a side of second sheet stacking means, said first sheet conveying means conveys the sheets held by said sheet holding means and the sheets stacked on said first sheet conveying means together and discharges the sheet stacked on said first sheet conveying means onto said second sheet stacking means.

[0082]

In a sheet processing apparatus of Embodiment 2, first sheet conveying means conveys a sheet, e.g. P1, P2 and P3, held by a sheet holding means ,e.g. the buffer unit 140, and a sheet stacked on the first sheet stacking means together and discharges a sheet stacked on the first sheet stacking means onto the second sheet stacking means. Therefore, it can achieve that a sheet bundle can be ensured to be separated from a buffer sheet and discharged onto the second sheet stacking means because an overlapped area between a sheet bundle and a buffer sheet is reduced by the predetermined amount in which a sheet bundle is conveyed, e.g. the length L. In addition, because a sheet is conveyed by the first sheet conveying means and the second sheet conveying means, it can achieve to discharge a sheet quickly without causing variations of the

sheet discharge times and provide an apparatus whose processing time is short.

[0083]

(Embodiment 3)

In a sheet processing apparatus of Embodiment 2, the second sheet conveying means conveys the sheet stacked on the first sheet stacking means until a downstream edge part of the sheet stacked on the first sheet stacking means is conveyed to be protruded from the downstream edge part of the sheet held by the sheet holding means.

[0084]

Because the second sheet conveying means conveys the sheet stacked on the first sheet stacking means until a downstream edge part of the sheet stacked on the first sheet stacking means is conveyed to be protruded from the downstream edge part of the sheet held by the sheet holding means, the first sheet conveying means finishes conveying the sheet stacked on the first stacking means before the sheet held by the sheet holding means. In the end, it can achieve that a sheet stacked on the first sheet stacking means is ensured to be discharged onto the second sheet stacking means

[0085]

Because a downstream edge part of the sheet stacked on the first sheet stacking means is protruded from the downstream edge part of the sheet held by the sheet holding means, a downstream edge part of the sheet held by the sheet holding means is protruded toward the upstream side of the upstream

edge part of the sheet stacked on the first sheet stacking means. In the end, the first sheet conveying means holds a sheet held by sheet holding means for a long time and ensures to stack sheets held by the first sheet stacking means.

[0086]

(Embodiment 4)

In a sheet processing apparatus of Embodiments 2 and 3, the second sheet conveying means conveys a sheet stacked on the first sheet stacking means by pushing the trailing edge of the sheet stacked on the first sheet stacking means in a sheet conveying direction.

[0087]

Because a sheet processing apparatus of Embodiment 4 conveys a sheet stacked on the first sheet stacking means by pushing the trailing edge of the sheet stacked on the first sheet stacking means in a sheet conveying direction, it can achieve convey a sheet without damaging the sheet unlike a sheet discharge by pressing the roller onto a surface of a sheet rotating with pressure.

[0088]

(Embodiment 5)

In a sheet processing apparatus of Embodiment 2, the sheet holding means has a holding sheet conveying part which conveys the held sheet wherein the sheet conveying speed of the sheet holding means is set to be the same as that of the first sheet conveying means.

[0089]

In a sheet processing apparatus of Embodiment 5, because the sheet conveying speed of the sheet holding part, e.g. the first discharging roller pairs is set to be the same as that of the first sheet conveying means, when the holding sheet conveying part and the first sheet conveying means coveys the sheet held by sheet holding sheet means, it can prevent the holding sheet conveying part and the first sheet conveying means from pulling a sheet to tear it up or by pushing a sheet to make a wrinkle and maintain a quality of a sheet in constant.

[0090]

(Embodiment 6)

In a sheet processing apparatus of Embodiment 5, the start-up timing of the holding sheet conveying part and the first sheet conveying means are set so that the sheet conveying speeds of them are in constant when a sheet is conveyed.

[0091]

In a sheet processing apparatus of Embodiment 6, because the start-up timing of the holding sheet conveying part and the first sheet conveying means are set so that the sheet conveying speeds of them are in constant, even though there is a different of the conveying speed between the holding sheet conveying part and the first sheet conveying means, the difference can be solved when the holding sheet conveying part and the first sheet conveying means convey a sheet and prevent the holding sheet conveying part and the first sheet conveying means from pulling a sheet to tear it up or by pushing a sheet

to make a wrinkle and maintain a quality of a sheet in constant.

[0092]

(Embodiment 7)

In a sheet processing apparatus of any one of Embodiments 1 to 6, the sheet conveying speeds of the first sheet conveying means and the second sheet conveying means are set to be in constant.

[0093]

In a sheet processing apparatus of Embodiment 6, because the sheet conveying speeds of the first sheet conveying means and the second sheet conveying means are set to be in constant, when a sheet is conveyed by the first sheet conveying means and the second sheet conveying means, it can prevent the first sheet conveying means of the second sheet conveying means from pulling a sheet to tear it up or by pushing a sheet to make a wrinkle and maintain a quality of a sheet in constant.

[0094]

(Embodiment 8)

In a sheet processing apparatus of any one of Embodiments 1 to 7, the start-up timing of the first sheet conveying means and the second sheet conveying means are set so that the sheet conveying speeds of them are in constant when a sheet is conveyed.

[0095]

In a sheet processing apparatus of Embodiment 8, because the start-up timing of the first sheet conveying means and the second sheet conveying means are set so that the sheet

conveying speeds of them are in constant when a sheet is conveyed, even though there is a different of the conveying speed between the first sheet conveying means and the second sheet conveying means, the difference can be solved when the first sheet conveying means and the second sheet conveying means convey a sheet and prevent the first sheet conveying means and the second sheet conveying means from pulling a sheet to tear it up or by pushing a sheet to make a wrinkle and maintain a quality of a sheet in constant.

[0096]

(Embodiment 9)

An image forming apparatus, comprising image forming means which forms an image on a sheet, and a sheet processing apparatus which applies processing to the sheet on which the image is formed by the image forming means, wherein the sheet processing apparatus is a sheet processing apparatus according to any one of the embodiments 1 to 8.

[0097]

An image forming apparatus in Embodiment 9 can increase the productivity because it has a sheet processing apparatus ensured to discharge a sheet.

[0098]

An image forming apparatus in Embodiment 9 can provide a sheet onto which a high quality image is formed, for a long time, because it has a sheet processing apparatus which gives a sheet less damage.

[0099]

[Effect of the Invention]

In a sheet processing apparatus of the present invention, the first sheet conveying means and the second sheet conveying means are ensured to discharge a sheet on the first sheet conveying means and the second sheet conveying means. In addition, because a sheet is conveyed by the first sheet conveying means and the second sheet conveying means, it can achieve to discharge a sheet quickly without causing variations of the sheet discharge times and provide an apparatus whose processing time is short.

[0100]

In a sheet processing apparatus of the present invention, after the first sheet conveying means conveys a predetermined amount of sheets among the sheets stacked on the first sheet stacking means toward the side of the second sheet stacking means, the first sheet conveying means conveys the sheet held by sheet holding means and the sheet stacked on the first sheet stacking means together and discharges the sheet stacked on the first sheet stacking means onto the second sheet stacking means. Therefore, it can achieve that a sheet bundle can be ensured to be separated from a buffer sheet and discharged onto the second sheet stacking means because an overlapped area between a sheet bundle and a buffer sheet is reduced by the predetermined amount in which a sheet bundle is conveyed. In addition, because a sheet is conveyed by the first sheet conveying means and the second sheet conveying means, it can achieve to discharge a sheet quickly without causing

variations of the sheet discharge times and provide an apparatus whose processing time is short.

[Brief Description of the Drawings]

[Figure 1]

A front schematic sectional view of a copying machine which is an image forming apparatus including a sheet processing apparatus according to an embodiment of the present invention in an apparatus main body.

[Figure 2]

A control block diagram of the copying machine of Fig. 1.

[Figure 3]

A front schematic sectional view of the sheet processing apparatus according to the embodiment of the present invention.

[Figure 4]

A front schematic sectional view showing respective drive systems of the sheet processing apparatus according to the embodiment of the present invention.

[Figure 5]

An enlarged view of a main part of the sheet processing apparatus according to the embodiment of the present invention.

[Figure 6]

A view showing a state in which a trailing edge assist of Fig. 5 has moved.

[Figure 7]

A view showing a state in which the trailing edge assist has moved further from the state shown in Fig. 6.

[Figure 8]

A control block diagram of the sheet processing apparatus of Fig. 3.

[Figure 9]

A flowchart for explaining an action at the time when a sheet stack is discharged in the sheet processing apparatus of Fig. 3.

[Figure 10]

A diagram for explaining action timing of the trailing edge assist and an oscillation roller pair.

[Figure 11]

A diagram for explaining action timing of the trailing edge assist and the oscillation roller pair.

[Figure 12]

A diagram for explaining action timing of the trailing edge assist, the oscillation roller pair, and a first discharge roller pair.

[Figure 13]

Diagrams for explaining actions of the sheet processing apparatus in the case in which sheets do not have to be stored during sheet processing, wherein

(a) is a diagram for showing a state in which a first sheet has been fed into the sheet processing apparatus; and

(b) a diagram for showing a state in which the first sheet has been received.

[Figure 14]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 13 in the case in which sheets do not have to be stored during sheet processing, wherein

(a) is a diagram for showing a state in which the first sheet has passed through a first discharge roller; and

(b) is a diagram for showing a state in which the first sheet has fallen over a stack tray and a processing tray.

[Figure 15]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 14 in the case in which sheets do not have to be stored during sheet processing, wherein

(a) is a diagram for showing a state in which the first sheet is fed into the processing tray; and

(b) is a diagram for showing a state in which the first sheet is further fed into the processing tray.

[Figure 16]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 15 in the case in which sheets do not have to be stored during sheet processing, wherein

(a) is a diagram for showing a state in which a second sheet has been fed into the sheet processing apparatus; and

(b) is a diagram for showing a state in which the first sheet has come into abutment against a stopper.

[Figure 17]

A diagram for explaining actions of the sheet processing apparatus in the case in which sheets do not have to be stored during sheet processing and there sheets are stacked on the processing tray.

[Figure 18]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 17 in the case in which sheets do not have to be stored during sheet processing, wherein

(a) is a diagram for showing a state in which a sheet stack is started to be discharged to a stack tray from the processing tray; and

(b) is a diagram for showing a state in which a sheet stack is being discharged to a stack tray from the processing tray.

[Figure 19]

A diagram for explaining actions of the sheet processing apparatus in the case in which sheets do not have to be stored during sheet processing and shows a state in which the sheet stack has been discharged to the stack tray from the processing tray.

[Figure 20]

Diagrams for explaining actions of the sheet processing apparatus in the case in which sheets are stored during sheet processing, wherein

(a) is a diagram for showing a state in which a first

sheet has been fed into the sheet processing apparatus; and

(b) is a diagram for showing a state in which the first sheet has been received up to a switch-back point.

[Figure 21]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 20 in the case in which sheets are stored during sheet processing, wherein

(a) is a diagram for showing a state in which the first sheet has been received by a trailing edge receiving portion; and

(b) is a diagram for showing a state in which the first sheet has been held down to a lower conveyance guide plate by a trailing edge holding-down member.

[Figure 22]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 21 in the case in which sheets are stored during sheet processing, wherein

(a) is a diagram for showing a state in which a second sheet has been fed into the sheet processing apparatus; and

(b) is a diagram for showing a state in which the second sheet has been further fed into the sheet processing apparatus.

[Figure 23]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 22 in the

case in which sheets are stored during sheet processing, wherein

(a) is a diagram for showing a state in which the second sheet has been received up to the switch-back point;

(b) is a diagram for showing a state in which the second sheet has been received by a trailing edge receiving portion.

[Figure 24]

A diagram for explaining actions of the sheet processing apparatus in the case in which sheets are stored during sheet processing and shows a state in which the first and the second sheets are laid one on top of another and held down to the lower conveyance guide plate by the trailing edge holding-down member.

[Figure 25]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 24 in the case in which sheets are stored during sheet processing, wherein

(a) is a diagram for showing a state in which a third sheet has been fed into the sheet processing apparatus; and

(b) is a diagram for showing a state in which the third sheet has been fed into the sheet processing apparatus.

[Figure 26]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 25 in the case in which sheets are stored during sheet processing,

wherein

(a) is a diagram for showing a state in which a sheet stack is started to be discharged to the stack tray from the processing tray; and

(b) is a diagram for showing a state in which the sheet stack and a buffer sheet are being conveyed in a discharge direction.

[Figure 27]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 26 in the case in which sheets are stored during sheet processing, wherein

(a) is a diagram for showing a state in which the sheet stack has been discharged to the stack tray from the processing tray; and

(b) is a diagram for showing a state in which the buffer sheet is being fed into the processing tray.

[Figure 28]

Diagrams for explaining actions of the sheet processing apparatus following the actions of Fig. 27 in the case in which sheets are stored during sheet processing, wherein

(a) is a diagram for showing a state in which the buffer sheet is being fed into the processing tray; and

(b) is a diagram for showing a state in which the buffer sheet is being further fed into the processing tray.

[Figure 29]

A diagram for explaining actions of the sheet processing apparatus in the case in which a projection length of a downstream edge of a sheet stack from a downstream edge of a buffer sheet is short.

[Figure 30]

A diagram for explaining problems in the case in which a sheet stack is discharged only by an oscillation roller.

[Figure 31]

A schematic cross section view of a conventional sheet processing apparatus.

[Description of Reference Numerals or Symbols]

D … original

P … sheet

L … a difference in the projecting length between the sheet stack and the buffer sheet

S1 … inlet path sensor

SP … switch-back point

CL … under-clutch stack

M1 … common conveyance motor

M2 … inlet conveyance motor

M3 … stack delivery motor

M4 … trailing edge assist motor

100 … copying machine (image forming apparatus)

101 … apparatus main body

102 … original feeding apparatus

104 … feeding portion

114 … photosensitive drum (image forming means)

119 … sheet processing apparatus

121 … inlet roller pair

123a … upper conveyance guide plate

123b … lower conveyance guide plate

124 … buffer roller

126 … first discharge roller pair(holding sheet conveying part)

126a … upper first discharge roller

126b … lower first discharge roller

127 … oscillation roller pair (the first sheet conveying means)

127a … upper roller

127b … lower roller

128 … stack tray (the second sheet stacking means)

129 … processing tray (the first sheet stacking means)

130 … return roller

131 … stopper

132 … stapler unit

133 … sheet surface detection lever

134 … trailing edge assist(the second sheet conveying means)

135 … trailing edge holding-down member

136 … trailing edge receiving portion

137 … receiving roller pair

140 … buffer unit (sheet holding means)

141 … friction member

201 … CPU

210 … operation portion

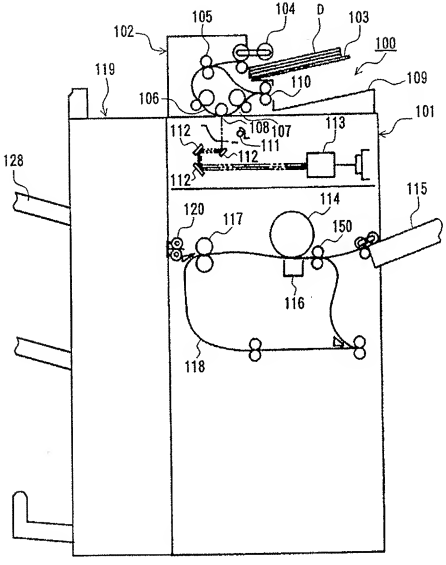
211 … finisher control portion

212 … FAX control portion

221 … CPU

【書類名】　図面　[Name of the Document] Drawings

【図１】　Fig.1



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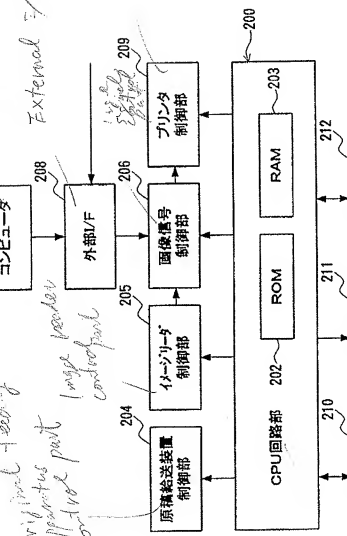
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RAM
205
イメージリーダ制御部
204
原稿給送装置制御部
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FAX制御部

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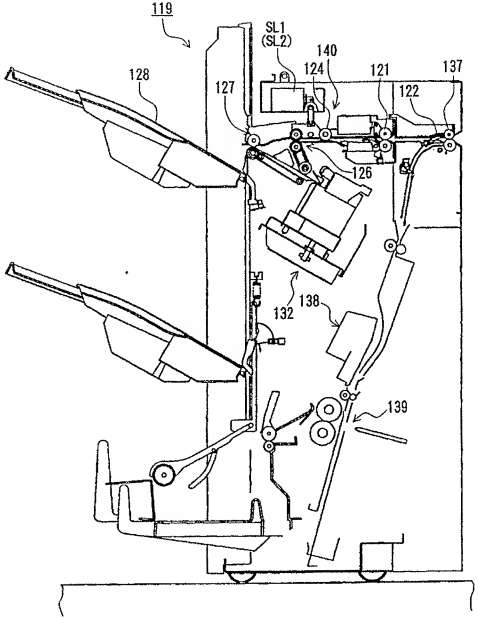
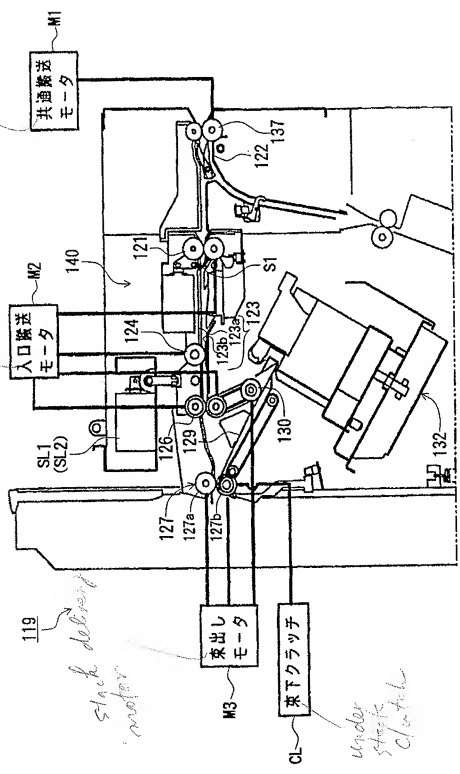
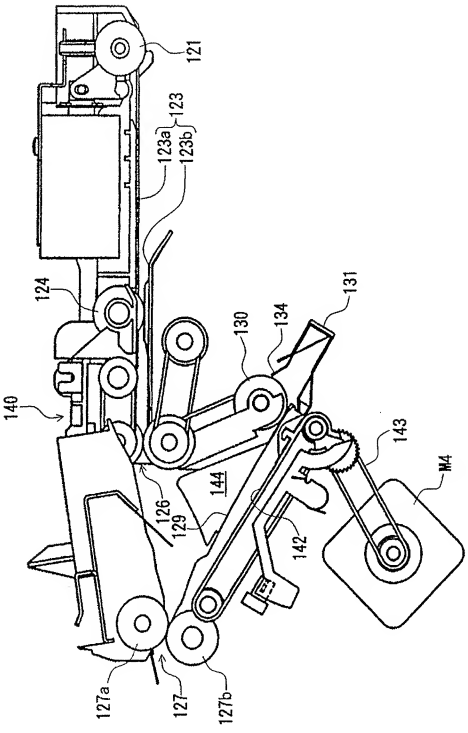


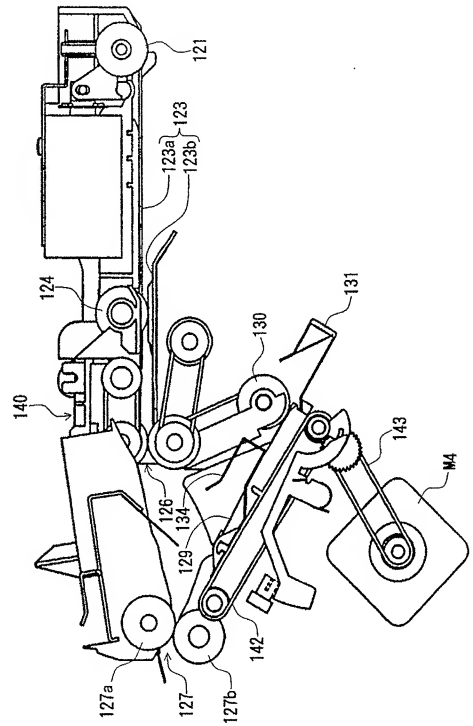
【図4】


M1
共通搬送
モータ
M2
入口搬送
モータ
SL1
(SL2)
119
M3
排出レ
モータ
CL
排下クラッチ
140
121
122
137
S1
123
124
123a
123b
126
129
130
132
127
127a
127b

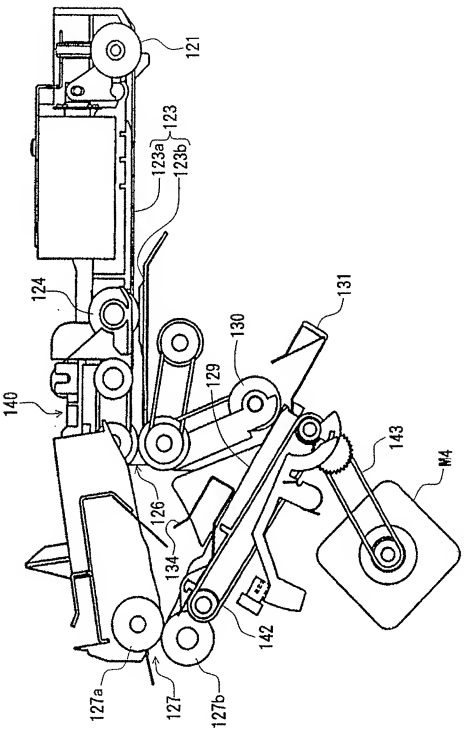
【図5】 Fig.5


121
123
123a
123b
124
131
134
130
140
143
M4
144
126
129
142
127a
127
127b

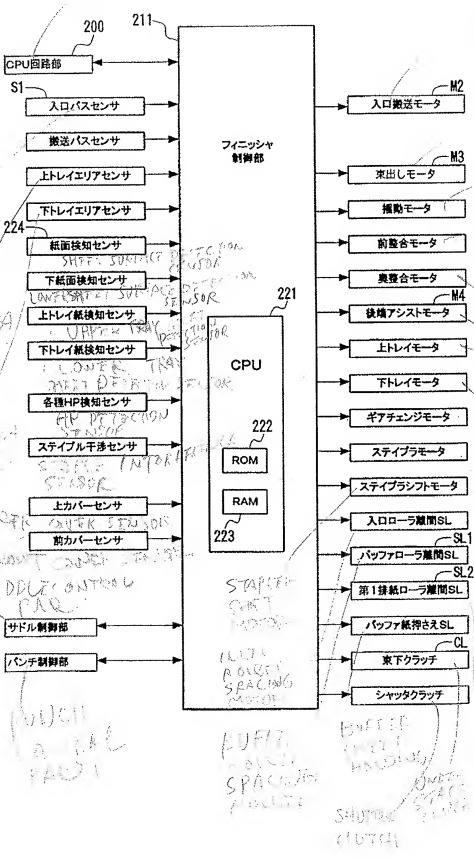
【図6】


121
123
123a
123b
124
131
130
140
143
M4
126
134
129
142
127a
127
127b

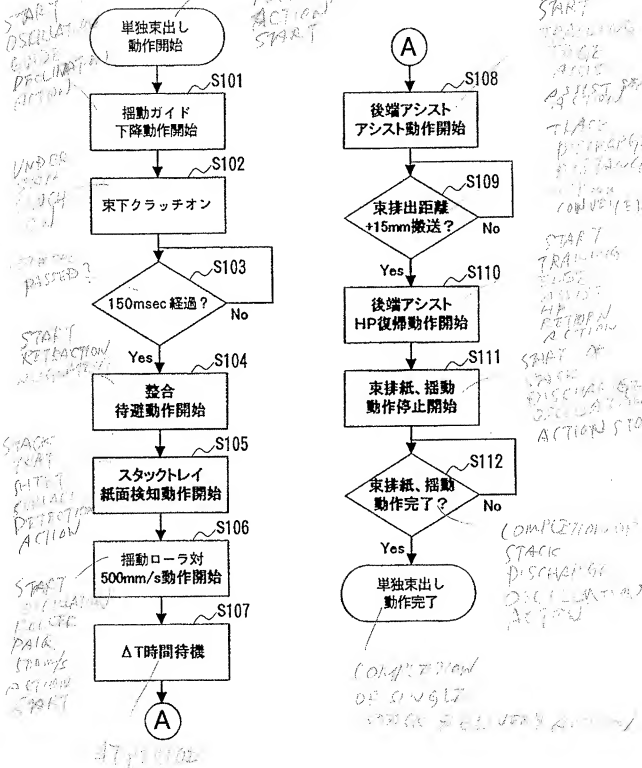
【図７】


121
123
123a
123b
124
131
130
129
140
143
M4
126
134
142
127a
127
127b

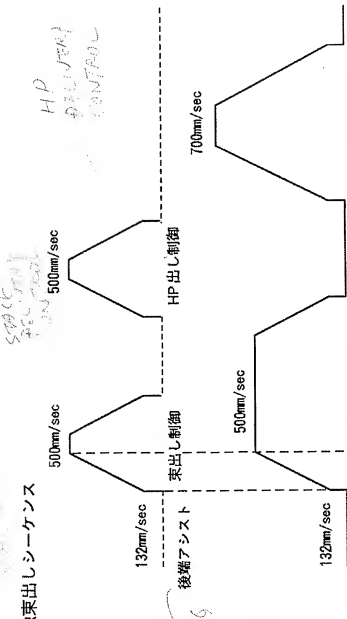
【図８】


200
211
CPU回路部
S1
入口パスセンサ
搬送パスセンサ
上トレイエリアセンサ
下トレイエリアセンサ
224
紙面検知センサ
下紙面検知センサ
上トレイ紙検知センサ
下トレイ紙検知センサ
各種HP検知センサ
ステイプル干渉センサ
上カバーセンサ
前カバーセンサ
サドル制御部
パンチ制御部
フィニッシャ制御部
221
CPU
222
ROM
RAM
223
M2
入口搬送モータ
M3
吸出しモータ
揺動モータ
前整合モータ
奥整合モータ
M4
後端アシストモータ
上トレイモータ
下トレイモータ
ギアチェンジモータ
ステイプラモータ
ステイプラシフトモータ
入口ローラ離間SL
SL1
バッファローラ離間SL
SL2
第1排紙ローラ離間SL
バッファ紙押さえSL
CL
束下クラッチ
シャッタクラッチ

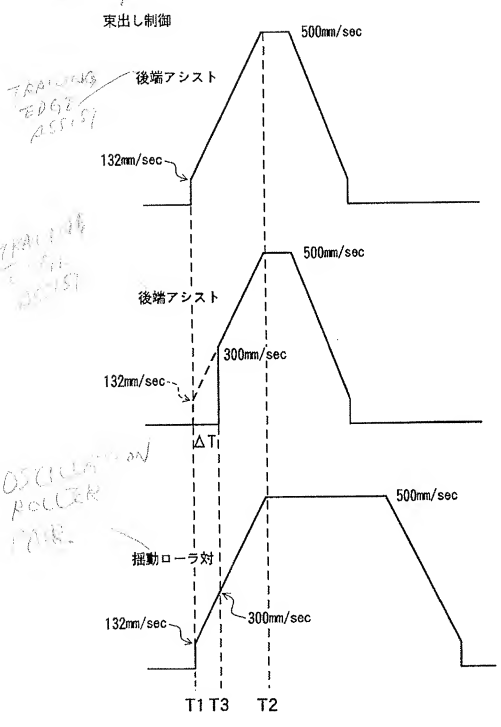
【図９】


単独束出し
動作開始
S101
揺動ガイド
下降動作開始
S102
束下クラッチオン
S103
150msec 経過？
No
Yes
S104
整合
待避動作開始
S105
スタックトレイ
紙面検知動作開始
S106
揺動ローラ対
500mm/s動作開始
S107
ΔT時間待機
A
A
S108
後端アシスト
アシスト動作開始
S109
束排出距離
+15mm搬送？
No
Yes
S110
後端アシスト
HP復帰動作開始
S111
束排紙、揺動
動作停止開始
S112
束排紙、揺動
動作完了？
No
Yes
単独束出し
動作完了

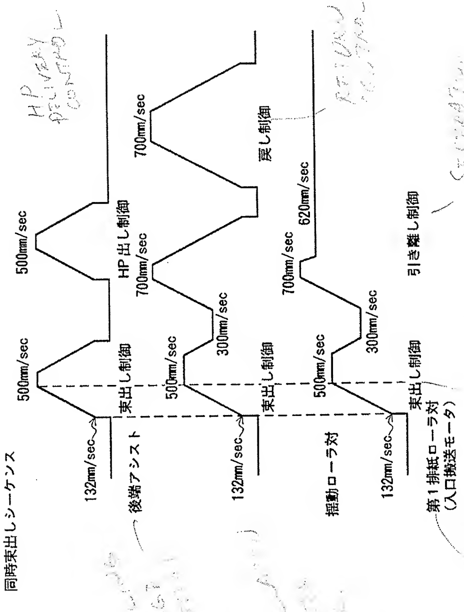
【図１０】


単独束出しシーケンス
500mm/sec
132mm/sec
後端アシスト
束出し制御
500mm/sec
HP出し制御
700mm/sec
戻し制御
132mm/sec
掴動ローラ対
束出し制御
500mm/sec
T1
T2

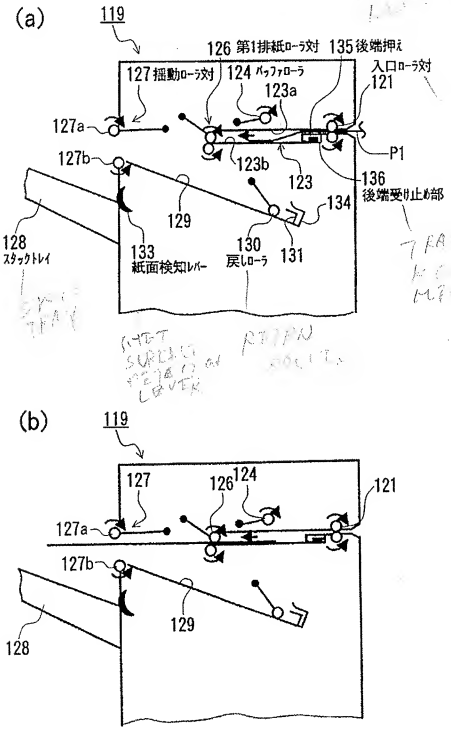
【図１１】


束出し制御
500mm/sec
後端アシスト
132mm/sec
500mm/sec
後端アシスト
300mm/sec
132mm/sec
ΔT
500mm/sec
揺動ローラ対
132mm/sec
300mm/sec
T1 T3
T2

【図１２】

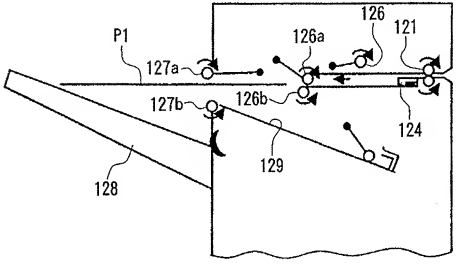

同時束出しシーケンス
後端アシスト
揺動ローラ対
第1排紙ローラ対
(入口搬送モータ)
132mm/sec
500mm/sec
300mm/sec
700mm/sec
620mm/sec
束出し制御
HP出し制御
戻し制御
引き離し制御

【図１３】

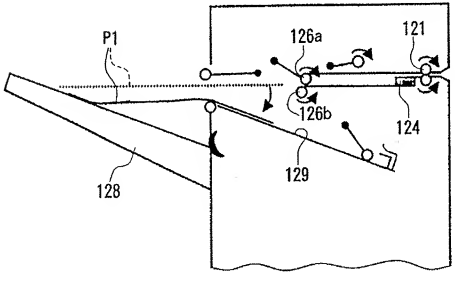

(a)
119
126 第1排紙ローラ対
135 後端押え
127 搬動ローラ対
124 バッファローラ
123a
入口ローラ対
121
127a
P1
127b
123b
123
136
後端受け止め部
134
129
128
スタックトレイ
133
紙面検知レバー
130
戻しローラ
131
(b)
119
127
126
124
121
127a
127b
129
128

【図１４】

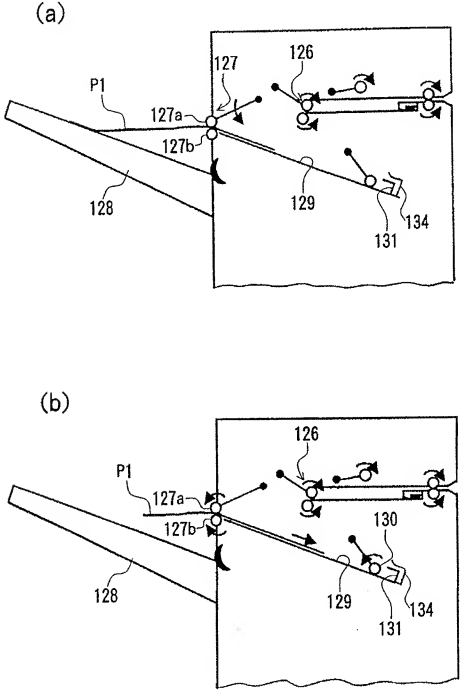
(a)


P1
127a
127b
126
126a
126b
121
124
129
128

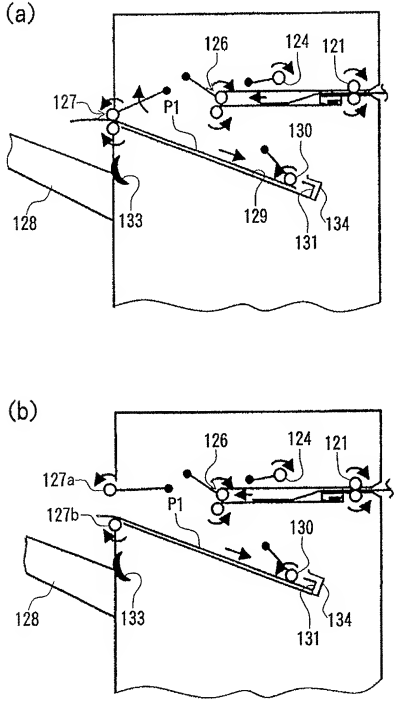
(b)


P1
126a
121
126b
124
129
128

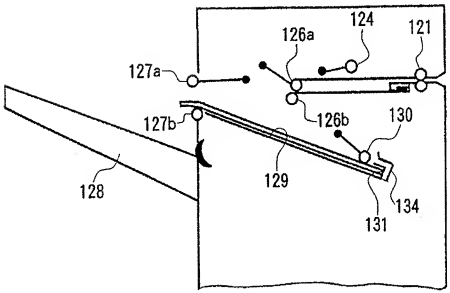
【図１５】 Fig 15


(a)
P1
127
126
127a
127b
128
129
131
134
(b)
P1
126
127a
127b
130
128
129
131
134

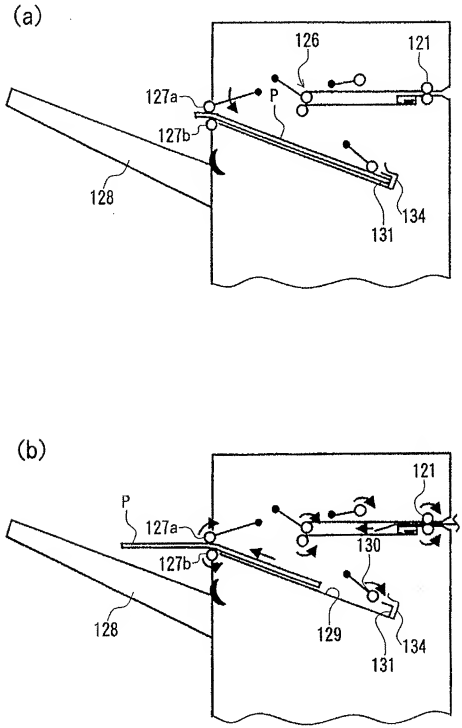
【図１６】 Fig.16


(a)
126
124
121
127
P1
130
128
133
129
134
131
(b)
126
124
121
127a
P1
127b
130
128
133
134
131

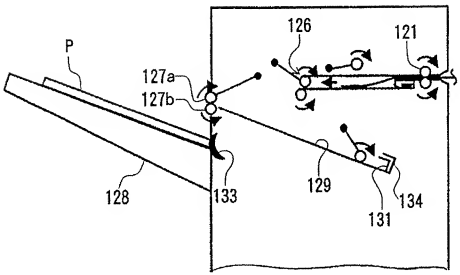
【図１７】



【図１８】

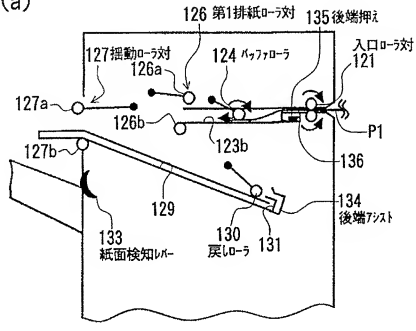

(a)
126
121
127a
P
127b
128
134
131
(b)
121
P
127a
130
127b
128
129
134
131

【図１９】

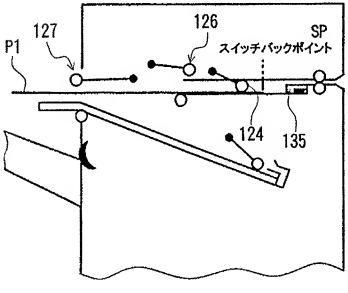


【図２０】

(a)

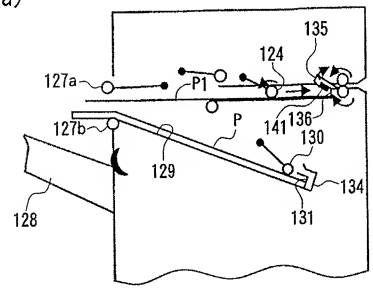

126 第1排紙ローラ対
135 後端押え
127 揺動ローラ対
126a
124 バッファローラ
入口ローラ対
121
127a
126b
P1
123b
127b
136
129
134
後端アシスト
133
紙面検知レバー
130
戻しローラ
131

(b)

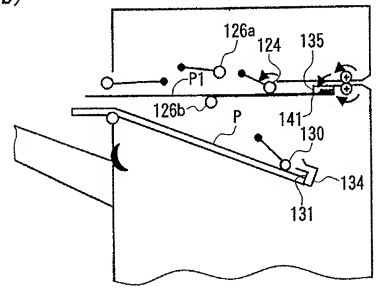

126
SP
127
P1
スイッチバックポイント
124
135

【図２１】

(a)

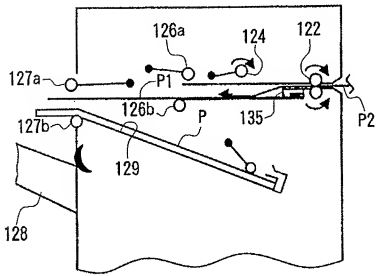

135
124
127a
P1
127b
P
141
136
130
129
134
128
131

(b)

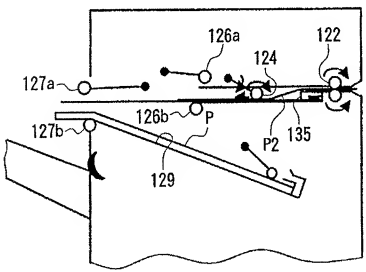

126a
124
135
P1
126b
P
141
130
134
131

【図２２】 18-22

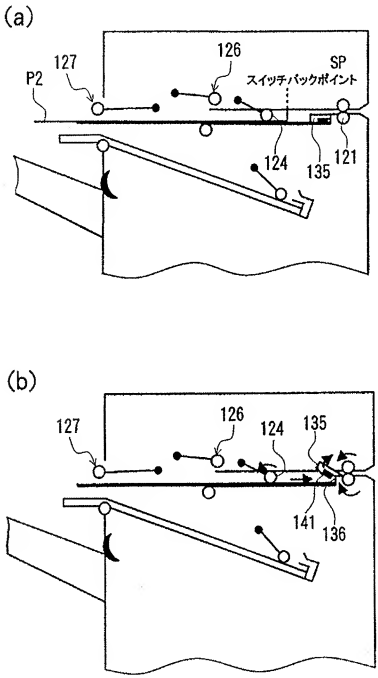
(a)


126a
124
122
127a
P1
126b
P
135
P2
127b
129
128

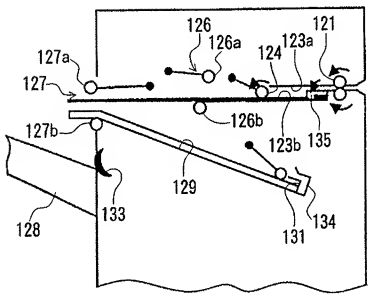
(b)


126a
122
124
127a
126b
P
P2
135
127b
129

【図２３】

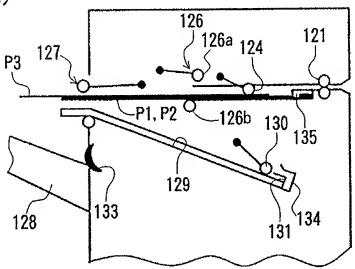

(a)
127
126
SP
P2
スイッチバックポイント
124
135
121
(b)
127
126
124
135
141
136

【図２４】

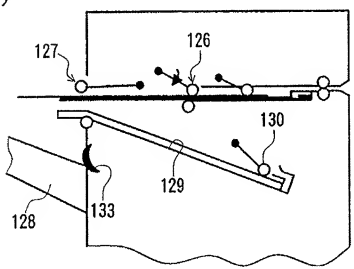

126
126a
121
123a
124
127a
127
126b
127b
123b
135
129
133
134
128
131

【図２５】

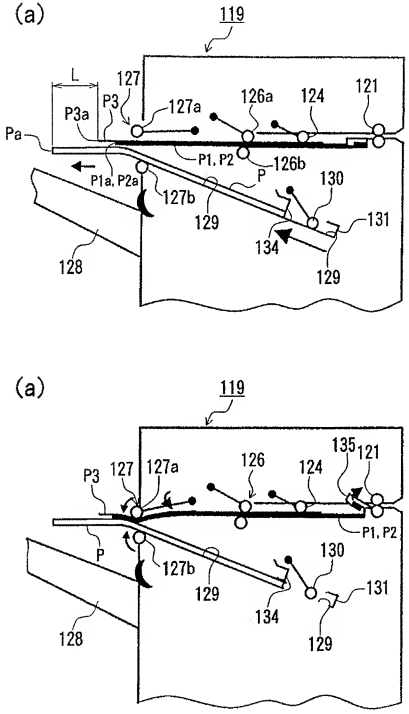
(a)


126
126a
124
121
127
P3
P1, P2
126b
130
135
129
133
128
131
134

(b)

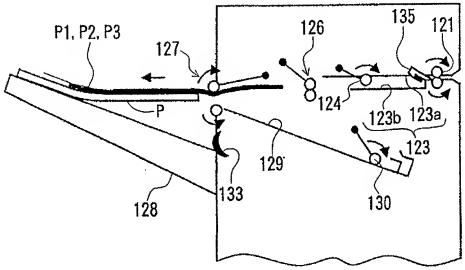

127
126
130
129
133
128

【図２６】

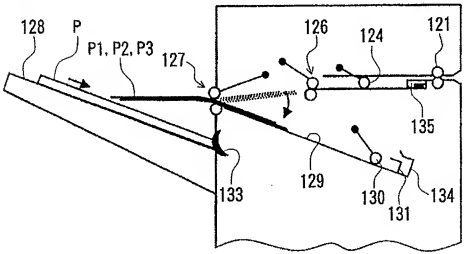

(a)
119
L
127
P3
P3a
Pa
127a
126a
124
121
P1, P2
126b
P1a, P2a
127b
P
130
129
131
134
128
129
(a)
119
135
121
P3
127
127a
126
124
P1, P2
P
127b
130
129
131
134
128
129

【図２７】

(a)

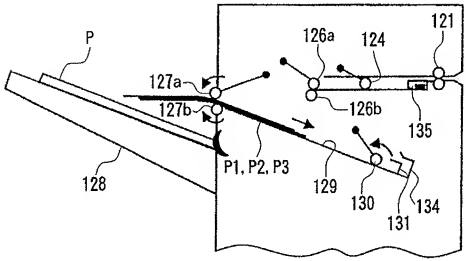

P1, P2, P3
127
126
135
121
124
123b
123a
123
P
129
133
128
130

(b)

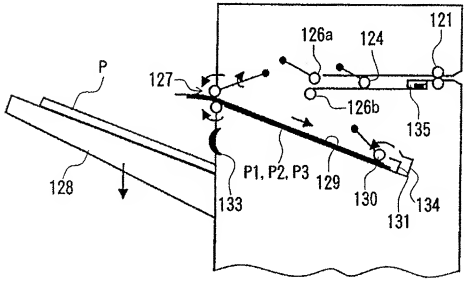

128
P
P1, P2, P3
127
126
124
121
135
133
129
130
131
134

【図２８】

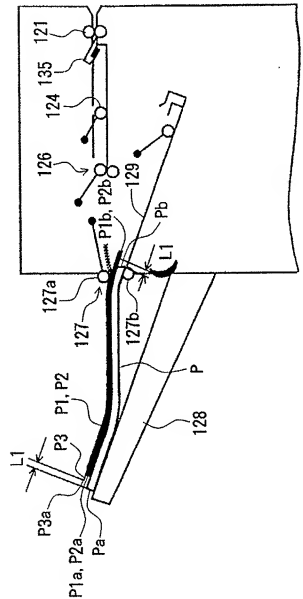
(a)


P
127a
127b
128
126a
124
121
126b
135
P1, P2, P3
129
130
131
134

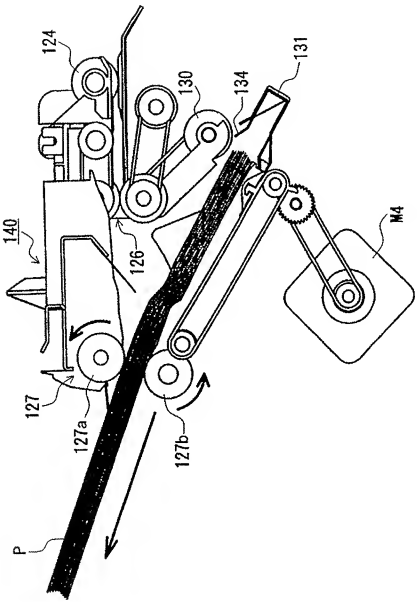
(b)


P
127
128
126a
124
121
126b
135
P1, P2, P3
129
130
131
134
133

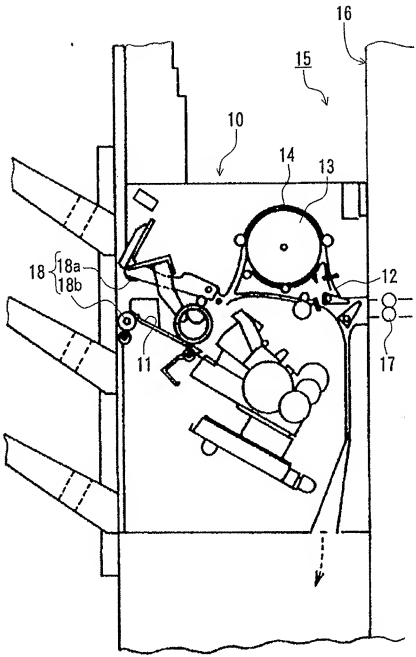
【図２９】


121
135
124
126
129
P2b
P1b, P2b
Pb
L1
127a
127
127b
P
P1, P2
P3
128
L1
P3a
P1a, P2a
Pa

【図３０】



【図３１】



[Name of the Document] Abstract

[Abstract]

[Object]

An object of the present invention is to ensure to discharge a sheet.

[Means for Achieving the Object]

A sheet processing apparatus 119 includes a process tray 129 which processes a sheet stacked on itself, a stack tray 128 on which a sheet provided toward the downstream side of the process tray 129 in a sheet conveying direction, an oscillation roller pair 127 which conveys a sheet stacked on the process tray 129 and discharges a sheet onto the stack tray 128, and a trailing edge assist 134 which conveys the sheet stacked on the process tray 129 toward the stack tray 128, wherein the sheet stacked on the process tray 129 is discharged onto the stack tray 128 by the oscillation roller pair 127 and the trailing edge assist 134.

[Elected Drawing]

Figure 13